

Corrosion behaviour of Al-Si cast alloy reinforced with titanium diboride (TiB₂) and scandium (Sc)

ABSTRACT

The aluminium-silicon (Al-Si) based on Metal Matrix Composites (MMCs) is widely used in lightweight constructions and transport applications requiring a combination of high strength and ductility. A grain refinement plays a crucial role in improving characteristics and properties of Al alloys. In this investigation, titanium diboride (TiB₂) and scandium (Sc) inoculants were added to the Al-Si alloys for grain refinement of an alloy. In this investigation, the corrosion resistance rate of Al-Si cast alloy reinforced by TiB₂ and Sc were measured by potentiostat (AUTOLAB) instrument. The aim of this research is to investigate the corrosion rate for Al-Si-TiB₂-Sc composites that immersed in different concentration of acidic solutions. Besides, the immersion time of acidic solutions also was investigated. All the samples were prepared accordingly for ASTM standard by the composition of 6.0 wt% TiB₂ and 0.6wt% Sc. All the samples undergo cold mounting technique for easy handling on corrosion tests. Then the samples were immersed in two different concentrations acidic medium solutions, which were 0.1 and 1.0 M hydrochloric acids (HCl). The corrosion rate also was investigated for immersion samples of 1.0 M HCl for 21 days. From the results obtained, added TiB₂ and Sc onto Al-Si alloy gave the better properties in corrosion resistance. Corrosion rates to reduce when the samples were immersed in a lower concentration of acidic medium, 0.1 HCl. However, there are some significant on the result but it still following the corrosion rates trend. Thus, improvements to reinforcement content need to be done in further research to cover the lack of this corrosion rates trend.

Keyword: Al-Si alloy; Metal matrix composites; Titanium diboride; Scandium; Corrosion rate